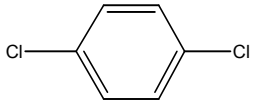
1,4-DICHLOROBENZENE
CAS No. 106-46-7
First Listed in the *Fifth Annual Report on Carcinogens*



CARCINOGENICITY

1,4-Dichlorobenzene (*p*-dichlorobenzene) is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC V.29, 1982; IARC S.7, 1987; NTP 319, 1987). When administered by gavage, the compound increased the incidences of hepatocellular carcinomas and adenomas in mice of both sexes. When administered by gavage, 1,4-dichlorobenzene increased the incidences of renal tubular cell adenocarcinomas in male rats, but there was no evidence of carcinogenicity in female rats.

There are no adequate data available to evaluate the carcinogenicity of 1,4-dichlorobenzene in humans (IARC V.29, 1982; IARC S.7, 1987). One study reported the occurrence of leukemia in five humans who had been exposed to dichlorobenzenes.

PROPERTIES

1,4-Dichlorobenzene occurs as colorless or white crystals (monoclinic prisms or leaflets) with a distinctive aromatic odor, similar to mothballs. It is practically insoluble in water and soluble in ether, chloroform, carbon disulfide, benzene, alcohol, and acetone. 1,4-Dichlorobenzene is noncorrosive, volatile, and combustible. 1,4-Dichlorobenzene is flammable when exposed to heat, flame, or oxidizers. When it is heated to decomposition, toxic gases and vapors (such as hydrochloric acid and carbon monoxide) are released.

USE

For the past 20 years 1,4-dichlorobenzene has been used primarily as a space deodorant in products such as room deodorizers, urinal and toilet bowl blocks, and diaper pail deodorizers and as an insecticide fumigant for moth control (about 34% of the 1,4-dichlorobenzene produced) (Chem. Prod., 1983b; Chem. Profile, 1987b). It is also used as an intermediate in the production of polyphenylene sulfide, a plastic used in the electrical and electronics industries (27%), and in the production of 1,2,4-trichlorobenzene (9%) (NTP 319, 1987; Chem. Profile, 1987b). The remainder of the 1,4-dichlorobenzene produced is used as a germicide/disinfectant; a soil fumigant; an insecticide for fruit borers and ants; a pesticide; an animal repellent; a chemical intermediate in the production of a variety of yellow, red, and orange pigments; in the manufacture of air deodorizers, dyes, pharmaceuticals, and resin-bonded abrasives; and as an agent to control mold and mildew growth on tobacco seeds, leather, and some fabrics (Kirk-Othmer V.5, 1979; SRI, 1982; Chem. Prod., 1983b; Chem. Profile, 1987b; ATSDR, 1997-R040).

PRODUCTION

1,4-Dichlorobenzene was first produced commercially in the United States in 1915 (IARC V.29, 1982). The 1998 Chemical Buyers Directory lists 13 U.S. suppliers of 1,4-dichlorobenzene, while *Chemcyclopedia 98* only names one domestic supplier (Tilton, 1997; Rodnan, 1997). The 1997 Directory of Chemical Producers identified three producers of the compound, yielding a total of 144 million lb (SRIa, 1997).

1993-1994 import volumes (7.2 and 6.7 million lb respectively) increased almost three-fold versus the period from 1990-1992 (ATSDR, 1997-R040). Exports were expected to increase by approximately 1 to 2% annually through 1989 because of the production of polyphenylene sulfide overseas. Growth of the market for deodorizers is expected to be slow, and the demand for 1,4-dichlorobenzene as an insecticidal fumigant for moth control has declined over the past few years (Chem. Profile, 1987b).

EXPOSURE

The primary route of potential human exposure to 1,4-dichlorobenzene is inhalation (NTP 319, 1987), with an average daily intake from ambient air estimated at about 35 µg (ATSDR, 1997-R040). There is also potential for dermal contact and ingestion of the chemical from residue in polyphenylene sulfide coatings of articles intended for repeated contact with food. 1,4-Dichlorobenzene has also been detected in meats and eggs following exposure of the animals (IARC V.29, 1982) and fish from contaminated waters. The concentrations in food are generally low so are not as significant as exposure from air (ATSDR, 1997-R040). This is also true for water. When released into water, the compound rapidly volatilizes. 1,4-Dichlorobenzene has been detected in ground water, but its concentrations are low and range from 0.006 to 0.41 µg/L (JRB, 1983).

The major potential sources of consumer exposure are its uses as a deodorizer and a moth control agent. Occupational exposure to 1,4-dichlorobenzene occurs during its manufacture, its conversion to polyphenylene sulfide, and its other industrial uses. Concentrations in urban areas and in the vicinity of hazardous waste sites generally average less than 4 µg/m^3, but indoor air concentrations of 1,4-dichlorobenzene may be one to three orders of magnitude higher where it is used as a space deodorizer or moth repellent (ATSDR, 1997-R040). Concentrations of 42 to 4,350 mg/m^3 have been measured in the air of various factories (NTP 319, 1987; Kirk-Othmer V.5, 1979). The ACGIH recommended threshold limit value is $\leq$ 75 ppm (450 mg/m^3) as an 8-hr time-weighted average (TWA) with a short-term exposure limit (STEL) of 110 ppm (665 mg/m^3) (ACGIH, 1986). In 1983, an EPA study estimated that 92% of the 1,4-dichlorobenzene consumed in the United States is released into the atmosphere. The Toxic Chemical Release Inventory (EPA) listed 23 industrial facilities that produced, processed, or otherwise used 1,4- dichlorobenzene in 1988 (TRI, 1990). In compliance with the Community Right-to-Know Program, the facilities reported releases of 1,4-dichlorobenzene to the environment which were estimated to total 1.8 million lb. According to the TRI of 1996, in 1994 the estimated releases to the environment were 177,783 lb from 21 large processing facilities. Of the total, discharges to air accounted for 97.4% (173,088 lb). Releases to water represented 0.9% of the total environmental release (1,595 lb), to soil, 0.6% (1,100 lb), and via underground injection, 1.1% (2,000 lb) (ATSDR, 1997-R040).

The Total Exposure Assessment Methodology (TEAM) study measured combined 1,3- and 1,4-dichlorobenzene levels in personal overnight samples collected from more than 570 individuals in four states. Levels measured were assumed to be representative of 1,4-dichlorobenzene because 1,3-dichlorobenzene has limited commercial production. Levels detected ranged from 0.03 to 1,550

μg/m^3 and mean levels ranged from 7.23 to 56.0 μg/m^3. Less than 5% of all samples were above 200 μg/m^3 and less than 1% were near the maximum (1,550 μg/m^3). Exposure sources were not pinpointed (Pellizzari et al., 1987; Sparacino et al., 1987). In two other studies, levels of 1,3- and 1,4-dichlorobenzene measured in two homes for the elderly and eight homes in Tennessee, respectively, were in the same range as that measured in the TEAM study. Median levels in this study were 0.56 and 2.9 μg/m^3 (Sheldon et al., 1985; Guerin, 1985).

In 1980, EPA reported that approximately 1 million workers in the United States are exposed to 1,4-dichlorobenzene during its production and processing (USEPA, 1980). However, industry sources state that recently less than 1,000 workers were potentially exposed annually (CPA, 1986). The National Occupational Exposure Survey (1981-1983) indicated that 27,242 workers, including 7,239 women, potentially were exposed to 1,4-dichlorobenzene in the workplace (NIOSH, 1984). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 697,803 workers were potentially exposed to 1,4-dichlorobenzene in the workplace (NIOSH, 1976). This estimate was based on observations of the actual use of the compound (1% of total observations), the use of tradename products suspected of containing the compound (3%), and the use of generic products suspected of containing the compound (95%).

REGULATIONS

CPSC is currently coordinating activities associated with 1,4-dichlorobenzene with EPA through the Chlorinated Solvents Integrated Strategies. EPA regulates 1,4-dichlorobenzene under the Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Food, Drug, and Cosmetic Act (FD&CA), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Resource Conservation and Recovery Act (RCRA), Safe Drinking Water Act (SDWA), and Toxic Substances Control Act (TSCA). CWA and CERCLA have designated a reportable quantity (RQ) of 100 lb, and RCRA identifies 1,4-dichlorobenzene as a constituent of hazardous waste. 1,4-Dichlorobenzene is subject to permitting requirements under CWA and RCRA, and has been selected for testing under TSCA. 1,4-Dichlorobenzene is registered as a pesticide under FIFRA, and as an inert ingredient of pesticides under FD&CA. A recommended secondary maximum contaminant level (SMCL) for 1,4-dichlorobenzene has been established under SDWA. A regulatory level of 7.5 mg/L has been set for 1,4-dichlorobenzene (SDWA). FDA considers 1,4-dichlorobenzene a generally safe compound when added to pesticide chemicals. OSHA has established a PEL of ≤ 75 ppm as an 8-hr TWA, with a ceiling of 110 ppm. OSHA also regulates 1,4-dichlorobenzene under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-39.